

IN THE CLAIMS:

1 1. (Original) An optical transmission system in which an optical signal is
2 transmitted from an optical transmitter to an optical receiver and outputted in a form of an output
3 electrical signal after a noise canceling process is performed, the noise canceling process
4 canceling out noise components which occur during the transmission, wherein

5 the optical receiver and the optical transmitter are connected to each other by one
6 optical fiber, through which an optical signal is transmitted before being intensity-modulated,

7 the optical receiver includes:

8 a first processing unit operable to receive an optical signal, intensity-modulate the
9 received optical signal, and split the intensity-modulated optical signal into two optical signals of
10 which respective intensity-modulated components are in antiphase;

11 first and second optical transmission fibers which transmit the two optical signals
12 respectively; and

13 a second processing unit operable to convert the two optical signals into electrical
14 signals respectively, and generate an output electrical signal by performing differential
15 amplification on the electrical signals.

1 2. (Original) The optical transmission system of Claim 1, wherein

2 the optical transmitter includes an output processing unit operable to receive an
3 electrical signal, convert the electrical signal into an optical signal, and transmit the optical signal
4 to the optical receiver via the optical fiber.

1 3. (Original) The optical transmission system of Claim 2, wherein

2 the first processing unit includes:

3 an intensity modulation subunit operable to receive an optical signal via the
4 optical fiber, intensity-modulate the received optical signal based on a modulated electrical
5 signal having a certain frequency, and thereby generate a modulated optical signal; and

6 an optical separation subunit operable to generate, from the modulated optical
7 signal, a first output optical signal and a second output optical signal of which respective
8 intensity-modulated components are in antiphase, and output the first and second output optical
9 signals to the first and second optical fibers respectively, and

10 the second processing unit includes:

11 an optical/electrical conversion subunit operable to convert the first and second
12 output optical signals into first and second electrical signals respectively; and

13 a differential amplification subunit operable to invert a phase of the second
14 electrical signal, add the phase-inverted second electrical signal to the first electrical signal, and
15 thereby generate the output electrical signal.

1 4. (Original) The optical transmission system of Claim 3, wherein

2 the first processing unit consists of a Mach-Zehnder type external modulator, and

3 the second processing unit consists of a balanced optical/electrical converter.

1 5. (Original) The optical transmission system of Claim 3, wherein

2 the electrical signal which the output processing unit receives is an intermediate
3 frequency signal having a frequency which is different from a frequency of a radio frequency
4 signal,

5 the modulated electrical signal is a local oscillator signal,
6 the intensity modulation subunit intensity-modulates the received optical signal
7 based on a frequency of the local oscillator signal, and thereby generates the modulated optical
8 signal of which intensity-modulated components have a frequency of the radio frequency signal,
9 the optical/electrical conversion subunit converts the first and second output
10 optical signals into the first and second electrical signals respectively, the first and second
11 electrical signals having the frequency of the radio frequency signal, and
12 the differential amplification subunit inverts the phase of the second electrical
13 signal, adds the phase-inverted second electrical signal to the first electrical signal, and thereby
14 generates the radio frequency signal.

1 6. (Original) The optical transmission system of Claim 2, wherein
2 the output processing unit includes:
3 a generation subunit operable to receive an electrical signal, convert the received
4 electrical signal into an optical signal, and output the optical signal to a third optical transmission
5 fiber; and
6 a polarization scrambler operable to receive the optical signal via the third optical
7 transmission fiber, change a polarization type of the optical signal randomly, and output the
8 optical signal to the optical receiver via the optical fiber.

1 7. (Original) The optical transmission system of Claim 6, wherein
2 the first processing unit receives an optical signal of which a polarization type
3 changes randomly from the optical transmitter via the optical fiber.

1 8. (Original) The optical transmission system of Claim 1, wherein

2 the optical receiver further includes:

3 a polarization control unit operable to receive an optical signal from the optical
4 transmitter via the optical fiber, and control a polarization of the optical signal so that the type of
5 the polarization of the optical signal becomes the same as a type of a polarization which the first
6 processing unit accepts, wherein

7 the first processing unit receives the optical signal of which the polarization is
8 controlled by the polarization control unit.

1 9. (Original) The optical transmission system of Claim 8, wherein

2 the polarization of the optical signal received by the polarization control unit
3 includes first polarization and second polarization,

4 the polarization which the first processing unit accepts is the first polarization,

5 the polarization control unit includes:

6 a separation subunit operable to split the optical signal into a first polarized signal
7 having the first polarization and a second polarized signal having the second polarization;

8 a rotation subunit operable to rotate the second polarization of the second
9 polarized signal so as to change the second polarization to the first polarization, and thereby
10 generate a third polarized signal having the first polarization; and

11 a combining subunit operable to combine the first polarized signal with the third
12 polarized signal, and thereby generate a combined optical signal having only the first
13 polarization, and

14 the optical signal of which the polarization is controlled by the polarization
15 control unit is the combined optical signal.

1 10. (Original) The optical transmission system of Claim 1
2 the optical transmitter includes:
3 an output processing unit operable to receive an electrical signal, convert the
4 electrical signal into an optical transmission signal, and output the optical transmission signal to
5 a third optical transmission fiber,
6 a conversion processing unit operable to convert a modulated electrical signal
7 having a certain frequency into a modulated optical signal, and output the modulated optical
8 signal to a fourth optical transmission fiber, and
9 a multiplexing unit operable to receive the optical transmission signal via the third
10 optical transmission fiber and the modulated optical signal via the fourth optical transmission
11 fiber respectively, multiplex the optical transmission signal with the modulated optical signal,
12 thereby generate multiplexed optical signal, and output the generated multiplexed optical signal
13 to the optical receiver.

1 11. (Original) The optical transmission system of Claim 10, wherein
2 the optical receiver further includes:
3 an optical separation subunit operable to receive the multiplexed optical signal
4 from the optical transmitter via the optical fiber, split the multiplexed optical signal into the
5 optical transmission signal and the modulated optical signal, and output the optical transmission
6 signal and the modulated optical signal to the first processing unit and a fifth optical transmission
7 fiber respectively; and

8 a first optical/electrical conversion subunit operable to receive the modulated
9 optical signal via the fifth optical transmission fiber, convert the modulated optical signal into a
10 modulated electrical signal, and output the modulated electrical signal to the first processing unit,
11 the optical signal received by the first processing unit is the optical transmission
12 signal,
13 the first processing unit includes:
14 an intensity modulation subunit operable to intensity-modulate the received
15 optical transmission signal based on a frequency of the modulated electrical signal, and thereby
16 generate a modulated optical signal;
17 an optical separation subunit operable to generate, from the modulated optical
18 signal, a first output optical signal and a second output optical signal of which respective
19 intensity-modulated components are in antiphase, and output the first and second output optical
20 signals to the first and the second optical fibers respectively, and
21 the second processing unit includes:
22 a second optical/electrical conversion subunit operable to convert the first and
23 second output optical signals into first and second electrical signals respectively; and
24 a differential amplification subunit operable to invert a phase of the second
25 electrical signal, add the phase-inverted second electrical signal to the first electrical signal, and
26 thereby generate the output electrical signal.

1 12. (Original) The optical transmission system of Claim 11, wherein
2 the electrical signal which the output processing unit receives is an intermediate
3 frequency signal having a frequency which is different from a frequency of a radio frequency
4 signal,
5 the modulated electrical signal is a local oscillator signal,
6 the intensity modulation subunit intensity-modulates the received optical
7 transmission signal based on a frequency of the local oscillator signal so as to generate the
8 modulated optical signal of which intensity-modulated components have a frequency of the radio
9 frequency signal,
10 the second optical/electrical conversion subunit converts the first and second
11 output optical signals into the first and second electrical signals respectively, the first and second
12 electrical signals having the frequency of the radio frequency signal, and
13 the differential amplification subunit inverts the phase of the second electrical
14 signal, and adds the phase-inverted second electrical signal to the first electrical signal so as to
15 generate the radio frequency signal.

1 13. (New) An optical transmission method that is used for an optical transmission
2 system in which an optical signal is transmitted from an optical transmitter to an optical receiver
3 and outputted in a form of an output electrical signal after a noise canceling process is
4 performed, the noise canceling process canceling out noise components which occur during the
5 transmission, wherein

6 the optical receiver and the optical transmitter are connected to each other by one
7 optical fiber, through which an optical signal is transmitted before being intensity-modulated,

8 the optical receiver performs:

9 a first processing step of receiving an optical signal, intensity-modulating the
10 received optical signal, and splitting the intensity-modulated optical signal into two optical
11 signals of which respective intensity-modulated components are in antiphase;

12 a transmission step of transmitting the two optical signals with use of first and
13 second optical transmission fibers respectively; and

14 a second processing step of converting the two optical signals into electrical
15 signals respectively, and generating an output electrical signal by performing differential
16 amplification on the electrical signals.

1 14. (New) The optical transmission method of Claim 13, wherein

2 the optical transmitter performs an output processing step of receiving an
3 electrical signal, converting the electrical signal into an optical signal, and transmitting the
4 optical signal to the optical receiver via the optical fiber.

1 15. (New) The optical transmission method of Claim 14, wherein

2 the first processing step performs:

3 an intensity modulation step of receiving an optical signal via the optical fiber,
4 intensity-modulating the received optical signal based on a modulated electrical signal having a
5 certain frequency, and thereby generating a modulated optical signal; and

6 an optical separation step of generating, from the modulated optical signal, a first
7 output optical signal and a second output optical signal of which respective intensity-modulated
8 components are in antiphase, and outputting the first and second output optical signals to the first
9 and second optical fibers respectively, and

10 the second processing step performs:

11 an optical/electrical conversion step of converting the first and second output
12 optical signals into first and second electrical signals respectively; and

13 a differential amplification step of inverting a phase of the second electrical
14 signal, adding the phase-inverted second electrical signal to the first electrical signal, and thereby
15 generating the output electrical signal.

1 16. (New) The optical transmission method of Claim 15, wherein

2 the first processing step is performed in a Mach-Zehnder type external modulator,

3 and

4 the second processing step is performed in a balanced optical/electrical converter.

1 17. (New) The optical transmission method of Claim 15, wherein
2 the electrical signal processed in the output processing step is an intermediate
3 frequency signal having a frequency which is different from a frequency of a radio frequency
4 signal,
5 the modulated electrical signal is a local oscillator signal,
6 the intensity modulation step intensity-modulates the received optical signal based
7 on a frequency of the local oscillator signal, and thereby generates the modulated optical signal
8 of which intensity-modulated components have a frequency of the radio frequency signal,
9 the optical/electrical conversion step converts the first and second output optical
10 signals into the first and second electrical signals respectively, the first and second electrical
11 signals having the frequency of the radio frequency signal, and
12 the differential amplification step inverts the phase of the second electrical signal,
13 adds the phase-inverted second electrical signal to the first electrical signal, and thereby
14 generates the radio frequency signal.

1 18. (New) The optical transmission method of Claim 14, wherein
2 the output processing step performs:
3 a generation step of receiving an electrical signal, converting the received
4 electrical signal into an optical signal, and outputting the optical signal to a third optical
5 transmission fiber; and
6 a polarization scramble step of receiving the optical signal via the third optical
7 transmission fiber, changing a polarization type of the optical signal randomly, and outputting
8 the optical signal to the optical receiver via the optical fiber.

1 19. (New) The optical transmission method of Claim 18, wherein
2 the first processing step receives an optical signal of which a polarization type
3 changes randomly from the optical transmitter via the optical fiber.

1 20. (New) The optical transmission method of Claim 13, wherein
2 the optical receiver further performs:
3 a polarization control step of receiving an optical signal from the optical
4 transmitter via the optical fiber, and controlling a polarization of the optical signal so that the
5 type of the polarization of the optical signal becomes the same as a type of a polarization which
6 the first processing step accepts, wherein
7 the first processing step receives the optical signal of which the polarization is
8 controlled by the polarization control step.

1 21. (New) The optical transmission method of Claim 20, wherein
2 the polarization of the optical signal received by the polarization control step
3 includes first polarization and second polarization,
4 the polarization which the first processing step accepts is the first polarization,
5 the polarization control step performs:
6 a separation step of splitting the optical signal into a first polarized signal having
7 the first polarization and a second polarized signal having the second polarization;
8 a rotation step of rotating the second polarization of the second polarized signal so
9 as to change the second polarization to the first polarization, and thereby generating a third
10 polarized signal having the first polarization; and
11 a combining step of combining the first polarized signal with the third polarized
12 signal, and thereby generating a combined optical signal having only the first polarization, and
13 the optical signal of which the polarization is controlled by the polarization
14 control step is the combined optical signal.

1 22. (New) The optical transmission method of Claim 13

2 the optical transmitter performs:

3 an output processing step of receiving an electrical signal, converting the
4 electrical signal into an optical transmission signal, and outputting the optical transmission signal
5 to a third optical transmission fiber,

6 a conversion processing step of converting a modulated electrical signal having a
7 certain frequency into a modulated optical signal, and outputting the modulated optical signal to
8 a fourth optical transmission fiber, and

9 a multiplexing step of receiving the optical transmission signal via the third
10 optical transmission fiber and the modulated optical signal via the fourth optical transmission
11 fiber respectively, multiplexing the optical transmission signal with the modulated optical signal,
12 thereby generating multiplexed optical signal, and outputting the generated multiplexed optical
13 signal to the optical receiver.

1 23. (New) The optical transmission method of Claim 22, wherein

2 the optical receiver further performs:

3 an optical separation step of receiving the multiplexed optical signal from the
4 optical transmitter via the optical fiber, splitting the multiplexed optical signal into the optical
5 transmission signal and the modulated optical signal, and outputting the optical transmission
6 signal and the modulated optical signal to the first processing step and a fifth optical
7 transmission fiber respectively; and

8 a first optical/electrical conversion step of receiving the modulated optical signal
9 via the fifth optical transmission fiber, converting the modulated optical signal into a modulated
10 electrical signal, and outputting the modulated electrical signal to the first processing step,

11 the optical signal received by the first processing means is the optical
12 transmission signal,

13 the first processing step includes:

14 an intensity modulation step of intensity-modulating the received optical
15 transmission signal based on a frequency of the modulated electrical signal, and thereby
16 generating a modulated optical signal;

17 an optical separation step of generating, from the modulated optical signal, a first
18 output optical signal and a second output optical signal of which respective intensity-modulated
19 components are in antiphase, and outputting the first and second output optical signals to the first
20 and the second optical fibers respectively, and

21 the second processing means includes:

22 a second optical/electrical conversion step of converting the first and second
23 output optical signals into first and second electrical signals respectively; and

24 a differential amplification step of inverting a phase of the second electrical
25 signal, adding the phase-inverted second electrical signal to the first electrical signal, and thereby
26 generating the output electrical signal.

1 24. (New) The optical transmission method of Claim 23, wherein
2 the electrical signal which the output processing step receives is an intermediate
3 frequency signal having a frequency which is different from a frequency of a radio frequency
4 signal,

5 the modulated electrical signal is a local oscillator signal,
6 the intensity modulation step intensity-modulates the received optical
7 transmission signal based on a frequency of the local oscillator signal so as to generate the
8 modulated optical signal of which intensity-modulated components have a frequency of the radio
9 frequency signal,

10 the second optical/electrical conversion step converts the first and second output
11 optical signals into the first and second electrical signals respectively, the first and second
12 electrical signals having the frequency of the radio frequency signal, and

13 the differential amplification step inverts the phase of the second electrical signal,
14 and adds the phase-inverted second electrical signal to the first electrical signal so as to generate
15 the radio frequency signal.